ELECTRO-ACOUSTIC SYSTEM

Field of the Invention

The present invention relates to an electro-acoustic system and more particularly to an electro-acoustic system for use in connection with a radio receiver, compact disc (CD) player or other electronic sound-generating equipment.

Background of the Invention

Earphones are used in connection with radio receivers, CD players, telephones or the like. One conventional type of earphones has earmuffs which fit over the ears and are connected together by a spring that urges the earmuffs against the ears. Another conventional type of earphones is of the earplug type wherein earplugs extend into the respective ear canals. The earplugs have a configuration that can be universally worn by all persons. These prior art earphones allow outside sounds to enter the ears. While outside sounds are disturbing when listening to radio, CD player or the like, it is important to prevent outside sounds from entering the ears if the radio receiver is being used by a policeman, fireman or other official.

Objects and Summary of the Invention

An object of the present invention is to provide an electro-acoustic system that transmits distortionless sound to an ear or ears from electronic sound-generating equipment.

It is another object of the present invention to provide an electroacoustic system which employs fitted earmolds.

The present invention is realized as an electro-acoustic system which comprises an earmold which is configured to fit into an ear and having a sound-conduction bore extending therethrough, a connector having an inner end fitted into an outer end of the sound-conduction earmold bore, a sound-conduction tubing with one end secured within an outer end of the connector and another end secured within a speaker assembly, an electrical cable having one end electrically connected to the speaker assembly, and an electrical plug at the other end of the electrical cable for electrical connection to electronic sound-generating equipment.

Preferably, the sound-conduction tubing has a curved configuration so as to fit behind the ear between the ear and the head, the electrical cable has a coiled section, and the sound-conduction bore has a seating member for connecting the connector to the earmold.

The sound-conduction bore, the sound-conduction connector bore and the sound-conduction tubing bore have a consistent diameter therealong thereby providing a smooth and continuous path from the speaker to the ear whereby the acoustical characteristics of the sound emanating from the speaker and traveling along the smooth and continuous path into the ear is not changed thereby, resulting in improved fidelity.

Brief Description of the Drawings

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is an exploded perspective view of a monaural electro-acoustic system and a radio receiver.

Figure 2 is a view similar to Figure 1 showing an assembled electro-acoustic system connected to the radio receiver.

Figure 3 is a cross-sectional view of part of the earmold, seating member, earmold-tubing connector, filter, sound-conduction tubing and a speaker.

Figure 4 is an exploded perspective view of a binaural electro-acoustic system and a radio receiver.

Detailed Description of the Invention

The monaural electro-acoustic system 10 shown in Figures 1-3 includes an earmold 12, seating member 14, earmold-tubing connector 16, filter 18, sound-conduction tubing 20, speaker assembly 22, a coiled electrical cable 24, an electrical connector 26, an electrical cable 28, an electrical plug 30 and a radio receiver 32.

Earmold 12 is molded from a suitable plastic material to conform to and frictionally fit within a person's ear. The earmold is a pliable plastic that is compressible when finger and thumb pressure is applied thereto which classifies it as a soft plastic material. The earmold can also be made of a rigid plastic material.

Referring specifically to Figure 3, the earmold 10 includes a sound-conduction bore 11 extending therethrough with an outer section 11a, having a diameter larger than sound-conducting bore 11b, extending from the outer section 11a to the end of the portion of the earmold that extends into the ear channel.

Seating member 14 has an annular section 14a and an annular shoulder 14b at an outer end. Seating member 14 is molded from a suitable plastic material and it is secured in outer section 11a of sound-conduction bore 11 as shown in Figure 3 with annular section 14a disposed in outer section 11a and annular shoulder 14b abutting against a surface of earmold 12 thereby limiting the movement of annular section 14a within outer section 11a. A space is provided within outer section 11a between inner end of annular section 14a and inner end of outer section 11a. The outer diameter of annular section 14a is about the same as that of outer section 11a so that annular section 14a fits snugly therein. A conventional adhesive can be used to secure the seating member 14 in position in outer section 11a.

Connector 16 is molded from a suitable plastic material such as clear vinyl. It is elbow-shaped with a bend of about 80 degrees. Connector 16 has a latching section in the form of a nubbin 16a at one end and a tubing-receiving section 16b at the other end. Tubing-receiving section 16b has a bore 16c that has a diameter only slightly larger than the outside diameter of sound-conduction tubing 20 so that an inner end of sound-conduction tubing 20 can be readily and frictionally fitted within bore 16c against filter 18 which abuts shoulder 16d. Filter 18 can be omitted if desired, then the end of the sound-conduction tubing 20 will abut shoulder 16d. A conventional

vinyl glue can be used to secure tubing 20 within the tubing-receiving section 16b of connector 16.

Filter 18 is a conventional filter and is manufactured by Knowles Electronics, Inc., Itasco, Illinois. The filter is generally of 680 to 4700 ohms.

A sound-conduction tubular passage 16e extends through connector 16 from bore 16c to the end of nubbin 16a and its diameter is the same as the inside diameter of sound-conduction tubing 20. An annular recess 16f is located in connector 16 rearward of nubbin 16a. The recess includes an annular barb 16g having a tapered outer surface and a vertical inner surface.

Connector 16 is mounted in sound-conduction bore 11 of earmold 12 as shown in Figure 3 with nubbin 16a extending through seating member 14 and being disposed in the space within outer section 11a. The inner surface of nubbin 16a engages the inner end of seating member 14. Annular barb 16g bitingly engages an inner surface of seating member 14. The outer surface of annular recess 16f engages annular shoulder 14b. Thus, the nubbin end of connector 16 is latchably secured in seating member 14 to secure connector 16 within earmold 12. The nubbin 16a in conjunction with annular barb 16g provides better latching of connector 16 with earmold 12 and also prevents leakage of sound.

The other end of sound-conducting tubing 20 is mounted on a projection 34 of a conventional speaker 36 housed in speaker assembly 22. The speaker is encased in a two-part plastic housing 38 that has interfitting inner ends. A suitable speaker 36 is manufactured by Knowles Electronics, Inc. The housing 38 snugly engages tubing 20 and electrical cable 24.

Electrical cable 24 is electrically connected to speaker 36 and to respective electrical contacts (not shown) in the male electrical connector of connector 26. Electrical cable 24 has a coiled section 24a that enables cable 24 to be stretched after which it will return to its original position.

Electrical wires in electrical cable 28 are respectively connected to electrical contacts (not shown) in a female electrical connector of electrical connector 26 and to electrical plug 30. The plug provides for electrically connecting to an electrical socket 32a of the associated electronic sound-generating equipment such as a radio receiver

32. Such sound-generating equipment includes CD players, telephones, police or fire radio receivers and the like.

In use, the earmold 12 which has been molded to fit the ear is inserted in the ear and curved sound conduction tubing is extended between the head and the ear. The electrical cable 24 extends along a side of the upper part of the body. The radio receiver 32 may be attached to the body, most likely strapped to a belt at the waist. A clip (not shown) on cable 24 clips the cable to clothing so that it remains in place along the body. The curved sound-conduction tubing in place behind the ear will assist in keeping the earmold within the ear, the coiled section 24a of the electrical cable 24 allows freedom of movement without placing stress on the earmold.

An important feature of the present invention is that the interior diameter of the sound-conduction tubing 20, the diameter of the sound-conduction tubular passage 16e of connector 16, and the diameter of the sound-conducting bore 11b are the same so that the continuous-flow sound-conduction path having the same diameter therealong is established. Thus, the fidelity of the frequencies of sound signals emanating from the radio receiver or other sound-generating electronic equipment are more true because of the continuous-flow sound-conduction path. Adding filter 18 within bore 16c at the end of sound-conduction tubing 20 shapes the output and gain of the signals from the radio receiver thereby achieving much better electro-acoustic effects.

Another important feature of the present invention is the curved sound-conduction tubing extending behind a person's ear along the head maintains the earmold within the ear. Also, use of the seating member in the sound-conduction bore of the earmold enables the nubbin end of the connector to be latchably secured in the sound-conduction bore.

Figure 4 shows a binaural electro-acoustic system 100 for use in both ears of a person and it uses the same components as the monaural electro-acoustic system 10 except that coiled electric cables 124 are interconnected in a sealed electrical connector 126 and electrical plug 130 is for binaural signals. Otherwise, the electro-acoustic system 100 is the same as that of electro-acoustic system 10.

From the foregoing, it can be discerned that a monaural and binaural electro-acoustic system for use in conjunction with portable sound-generating equipment has

been disclosed whereby the sound emanating from the sound-generating equipment is transmitted along a continuous-flow sound-conduction path that is non-distorted, thereby providing better listening. Moreover, the curved configuration of the sound-conduction tubing maintains the earmold within the ear and the coiled electric cable prevents strain on the earmold.

While the present invention has been described with reference to two specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.